Siglinda PERATHONER - CURRICULUM VITAE (Apr 26)

Family name, First name: Perathoner Siglinda
ORCID, Researcher ID: 0000-0001-8814-1972, A-6257-2010
Date of birth: May 12th, 1958 *Nationality*: Italy
URL for website: https://catalysis.unime.it/

She earned her PhD in Chemical Sciences in 1988, working on the photophysics and photochemistry of supramolecular systems with V. Balzani and J.M. Lehn, who won the Nobel Prize. She joined the University of Messina in 2001 and is currently a full professor of Industrial Chemistry and Director of the CASPE (Catalysis for Sustainable Production and Energy) center. She is the author of over 450 scientific publications and 5 books, and the editor of various special issues of journals. The current h-index is 87, with >32,500 citations and 346 articles with >10 citations (Google Scholar, Apr. 2026). Publications in many high-IF journals, such as *Nature Catalysis*, *Nature Communications, EES, and Angew. Chem. Int. Ed. Chemie* and *JACS*, etc. Among the prizes and recognitions were the Special Award in 2008 from "The Altran Foundation for Innovation" for the project on the development of artificial leaves for the conversion of CO_2; the participation in 2011 in the film "NanoInLife" produced by the European Commission to show the results of nanotechnologies to the public; the Mario Giacomo Levi Medal of the Italian Chemical Society of 2021 for the innovative activity that led to industrial achievements, and in 2021 the President's International Fellowship Initiative (PIFI) of the CAS (Chinese Academy as Visiting Scientists). Section Editor of Current Opinion in Green and Sustainable Chem. and Guest Editors for JEC and Catal. Today (Elsevier).

- **EDUCATION**

1999-2001 Postdoctoral contract and research grants, Univ. of Messina, Italy
1989-1996 Postdoctoral contract and research grants, Univ. of Bologna, Italy
1989 PhD in Chemical Sciences at the University of Bologna - Italy (prof. V. Balzani)
1984 Master (5Y Laurea degree) in Chemistry at the University of Bologna - Italy

- **CURRENT POSITION(S)**

2018 – today Full Professor (Industrial Chemistry), Univ. Messina - Italy, Dept. ChiBioFarAm
2018 – today Director of the Laboratory of Catalysis and Sustainable Production and Energy (CASPE), reference centre of the Interuniversity Consortium INSTM (Science & Techn. of Materials).

- **PREVIOUS POSITION(S)**

2003-2018 Associate Prof. (Industrial Chemistry), Univ. Messina - Italy, Dept. ChiBioFarAm
2015-2017 Academic Icon (Univ. Malaya, Kuala Lumpur, Malaysia), Nanocat Center
2012-2014 Member of the Board of the Interdiv group of catalysis of the Italian Chemical Society
2009-2011 Member of the Board of the Italian Zeolite Association
2001-2003 Researcher (Industrial Chemistry), Univ. Messina - Italy, Dept. Engineering

- **FELLOWSHIPS, AWARDS AND RECOGNITIONS**

2021 CAS (Chin. Acad. of Sciences) President's Int- Fellowship Initiative, PIFI (Visiting Sci.)
2021 Mario Giacomo Levi Medal of the Italian Chemical Society for the innovative activity carried out in the field of Chemistry that led to industrial implementation
2021-2025 World's top 2% scientists, according to the Stanford University ranking
2021 Member of the ASN (Italy) and ERC (EU) evaluation panels
2011 "NanoInLife", a film produced by the European Commission to show the public the results of nanotechnologies; interview with S. Perathoner and presentation of the results on CO_2
2010 Finalist of the European Sustainable Chemistry Award 2010 (EuCheMS)
2008 "Altran Foundation for Innovation", a special award for the project on the development of artificial trees for the conversion of CO_2
2006 EU ELCAT project (coord. S. Perathoner): selected among EU success stories, one of the eight projects selected in the entire energy sector

- **INSTITUTIONAL RESPONSIBILITIES (Selection)**

2022-today Member of the Board of the Industrial Chemistry Division of the Italian Chemical Society
2021- today Coordinator of the Sustainability and Environmental Innovation (SIA) degree course, class L-27,

Univ. Messina - Italy, Dept. ChiBioFarAm
2021- today Member of the National Commission for Scientific Evaluation 03 / C2
2019- today Board of Directors of the INSTM Materials Science and Techn. Consortium, Firenze, Italy

RESEARCH ACHIEVEMENTS AND PEER RECOGNITION

Track Record:

Last 10 years - *Scopus/SciVal*: 203 publications (75% articles, 11% reviews, other in books), of which ~60% as corresponding or first/last authors; ~75% in the top 25% journals; ~62% in the top 25% most cited publications worldwide); 77% in the top 10% most viewed publications worldwide; 38.3 average citations per publication; 3.05 average Field-Weighted Views Impact; 40% with international collaboration. *WoS*: 196 publications in peer-reviewed journals (25 reviews, 14 book chapters, 38 average citations per paper).

Below is a selection of *ten representative publications* (FWCI Field-Weighted Citation Impact):

1. Electrocatalytic Synthesis of Ammonia at Room Temperature and Atmospheric Pressure from Water and Nitrogen on a Carbon-Nanotube-Based Electrocatalyst, Chen S., Perathoner S. et al., *Angew. Chemie - Int. Ed*. (2017), 56, 2699 (IF 16.9), DOI: 10.1002/anie.201609533; Cited 589 times (99th percentile), FWCI 18.95
2. Operando spectroscopy study of the carbon dioxide electro-reduction by iron species on nitrogen-doped carbon, Genovese C., Perathoner S. et al., *Nature Comm.* (2018), 9, 935, DOI: 10.1038/s41467-018-03138-7 (IF 15.7). Cited 227 times (98th percentile), FWCI 7.28.
3. CO_2 recycling: A key strategy to introduce green energy in the chemical production chain, Perathoner S. et al., *ChemSusChem* (2014), 7, 1274 - 1282, DOI: 10.1002/cssc.201300926 (IF 7.8), Cited 223 times (98th percentile), FWCI 6.91.
4. Catalysis for biomass and CO_2 use through solar energy: Opening new scenarios for a sustainable and low-carbon chemical production, Lanzafame P., Perathoner S. et al, *Chem. Soc. Rev.* (2014), 43, 7562 - 7580, DOI: 10.1039/c3cs60396b (IF 39.0). Cited 197 times (78th percentile). FWCI 1.34.
5. CO_2 utilization: An enabling element to move to a resource-and energy-efficient chemical and fuel production, Ampelli C., Perathoner S., et al., *Phil. Trans. Royal Society A: Math., Phys. and Eng. Sci*. (2015), 373 (2037), DOI: 10.1098/rsta.2014.0177. Cited 192 times (99th percentile), FWCI 16.73.
6. Water Structure in the First Layers on TiO_2: A Key Factor for Boosting Solar-Driven Water-Splitting Performances, Verduci R., Perathoner S. et al., *J. Am. Chem. Soc.* 2024, 146, 26, 18061–18073 (IF 15.6). DOI: 10.1021/jacs.4c05042, Cited 28 times (94th percentile), FWCI 3.68.
7. Understanding the complexity in bridging thermal and electrocatalytic methanation of CO_2, Kang H., Ma J., Perathoner S., et al., *Chem Soc Rev* 2023, 52, 3627 (IF 39,0). DOI: 10.1039/D2CS00214K. Cited 60 times (85th percentile), FWCI 1.80.
8. Current density in solar fuel technologies, Romano V., Perathoner S., et al., *Energy Environ. Sci.*, 2021,14, 5760 (IF 30,8). DOI: 10.1039/D1EE02512K. Cited 45 times (59th percentile), FWCI 0.64.
9. Catalysis for e-Chemistry: Need and Gaps for a Future De-Fossilized Chemical Production, with Focus on the Role of Complex (Direct) Syntheses by Electrocatalysis, Papanikolaou G., Perathoner S. et al., *ACS Catal* 2022, 12, 2861 (IF 13,1). DOI: 10.1021/acscatal.2c00099. Cited 67 times (82th percentile), FWCI 1.51.
10. Enhanced performance in the direct electrocatalytic synthesis of ammonia from N_2 and H_2O by an in-situ electrochemical activation of CNT-supported iron oxide nanoparticles, Chen S., Perathoner S. et al., *J Energy Chem* 2020, 49, 22 (IF 14,9). DOI 10.1016/j.jechem.2020.01.011. Cited 42 times (88th percentile), FWCI 2.09.

Top publications by citations (over 1000) according to Scopus:

- Opportunities and prospects in the chemical recycling of carbon dioxide to fuels, Perathoner S. et al. *Catal. Today* (2009), 148 (3-4), 191 - 205 (IF 5,3). DOI: 10.1016/j.cattod.2009.07.075. Cited 1316 times (98th percentile, FWCI 8.25
- Nanocarbons for the development of advanced catalysts, Su D.S., Perathoner S., et al., *Chem. Rev.* (2013), 113 (8), 5782 - 5816 (IF 55,8). DOI: 10.1021/cr300367d. Cited 1241 times (99th percentile), FWCI 9.03
- Catalysis for CO_2 conversion: A key technology for rapid introduction of renewable energy in the value chain of chemical industries, Perathoner S. et al., *Energy and Environmental Science* (2013), 6, 1711 - 1731 (IF 30,8). DOI: 10.1039/c3ee00056g, Cited 1149 times (97th perc.), FWCI 6.23

Publications of the last three years in:

2025: Nature Comm., J. Energy Chem., J. CO_2 Utiliz., Energy & Fuels, Chem. Eng. J., Catal. Sci. & Techn., Chi. J. Catal., Chem. Rec., ACS Catal., Top. Catal., Chem. Eng. Trans.

2024: ChemSusChem, Int. J. H_2 Energy, Appl. Catal. B, JACS, EES Catal., Current Opinion Green and Sustainable Chem., Pure & Appl. Chem., J. Catal., Chem. Eng. J., Materials, Chem. Eng. Trans.
2023: Nature Catal., Energy & Env. Sci., Green Chem., MMM, Chem. Soc. Rev., ACS Catal., Current Opinions in Chem Eng, Catal. Today, Chem. Comm., Chem. Synth., and others

Several lectures as plenary, keynote, or invited at international conferences and advanced schools; details are available at https://catalysis.unime.it/invited-lecture.html.

Selection of 5 representative lectures (plenary, keynote, invited):
1. Electrocatalysis: facing the challenge of extending its use to go beyond fossil fuels, Europacat 2021, Prague, Czech Rep., 27/08-1/09 2023, keynote
2. Converting CO_2 in an artificial leaf device built with earth-abundant materials for combined H_2 production and storage as formate with solar-to-fuel efficiency > 10%, 20th International Conference on Carbon Dioxide Utilization – ICCDU XX, Bari, June 25-29, 2023, invited
3. Bridging nanoscience and electrocatalysis to design advanced electrodes, 44th Int Conference on Coord. Chem., Au. 28th- Sept. 2th, 2022, Rimini, Italy. keynote
4. Ernst Haage Symposium, November 22-24, 2017, Mülheim - Germany, plenary
5. Workshop on CO_2, Univ. Malaya (Kuala Lumpur, Malaysia), 20 July 2017, plenary

She has also served as **chairperson** in several International Conferences (ICEC2025, Europacat 13, etc.).

Coordinator of projects - selection (in addition being PI in several additional projects; EU DECADE, EPOCH, SUNER-C, GreenSwap, AMAZE, TERRA, A-LEAF, RECODE, PERFORM, SINCHEM, BIOFUR, etc.):
1. OCEAN (Oxalic acid from CO_2 using Electrochemistry at demonstratioN scale), Project ID767798, Call H2020-SPIRE-2017, as ERIC (coord. S. Perathoner). 1 Oct 2027 - 31 Jul 2022 Total cost: € 5 285 309,15
2. SCOOP (Novel Solar cells for solar-to-hydrogen COntinuOus Production), J43C24000190005 FISA-2022-00277, 01/06/2024-31/05/2028, tot. cost 1.896.579 €, PI/coordinator S. Perathoner
3. eCO2 (Innovative, scalable materials and devices for CO2 capture and valorization into e-fuels), CUP B53C22004060006, part of the "Network 4 Energy Sustainable Transition_NEST" project (MUR) Spoke 9, 1 year from Oct 1, 2024, Tot. cost: 350,000, PI/coordinator S. Perathoner
4. TESLA (Direct Electrocatalytic CO_2 Conversion Technology for the Production of E-Fuels), MUR RSH2A_000001, 3 years - end 30/06/2026, total cost: € 3.024.111,00, PI/coordinator S. Perathoner

Scientific profile

S Perathoner is internationally recognized in catalysis, particularly (in the last decade) for electrifying chemical processes and solar fuels. From the beginning, **the focus was on the supramolecular aspects and on understanding the photophysics and energy/charge mechanistic aspects**, which are at the core of the RAISE proposal. These aspects are among the pillars of the CASPE Laboratory, which she coordinates, and which synergetically combines them with other competences in reactor and process engineering, industrial process development, and catalysis.

She employed a multifaceted approach to accelerate this transformation, ranging from scientific advances[1] and prototype engineering and development[2] to exploring novel, unconventional directions and catalysis.[3] This proposal falls under the last path and the effort, aiming for a foundational understanding of electrocatalysis and its design [3c, 4] She pioneered gas-phase-type electrocatalytic reactors (zero-gap) for CO_2 conversion,[2b, 5] demonstrating the role of reactor/electrode in determining the pathways of transformation.[2b, 5a, 6] Her reviews on CO_2 conversion and reuse are among the top-cited,[7] as are those on nanocarbon catalysis.[8] She also contributed to the techno-economic and sustainability assessment of CO_2 utilization processes.[9] Among other contributions, he pioneered producing i) C3 hydrocarbons and alcohols by electrocatalytic reduction of CO_2,[5] ii) olefins from CO_2[10], iii) new aspects in the mechanism of C-C bond formation in CO_2 electroreduction,[11] and iv) showed the dynamic change of the electrocatalysts during CO_2 conversion by operando spectroscopies and the role of the dynamics at polarised CO_2–iron oxyhydroxide interfaces.[1h, 12]

She addressed catalysis, and specifically the conversion of small molecules (CO_2, N_2, H_2O, CH_4) from multiple viewpoints: i) traditional heterogeneous catalysis, ii) electrocatalysis, iii) photo- and/or photoelectro-catalysis and iv) plasma catalysis. Recently, she reported the conversion of CO_2 to CO and O_2 via a combination of plasma activation and catalysis.[13] Relevant is also his pioneering contribution to developing the electrocatalytic N_2 to NH_3 conversion

using iron-based nanocatalysts to distribute ammonia as an H-vector.[14] All these developments provide the scientific basis for extending electrocatalysis to novel areas, as the focus of this prospect.

The scientific profile, expertise, and capabilities are well-suited to successfully executing the project and demonstrating the ability to conduct groundbreaking research.

Ten selected research outputs:

1. Addressing the Complexity of Bridging Thermal and Reactive Catalysis. The Role of Strong Localised Electrical Fields, S Perathoner et al. *Topics in Catal.* **2025**, 1-18. DOI: 10.1007/s11244-025-02062-7
   This paper sheds light on the differences between thermal (on one side) and photo-, electro-, and plasma (reactive) catalysis (on the other side). It reports the role of strong localised electrical fields (LEF) generated by the coupling of charges with localised phonon modes, i.e., catalyst vibrations.
2. Does the presence of only specific active sites control the switch of selectivity from C1 to C2+ products in CO_2RR? S Perathoner et al. *J. CO_2 Utiliz.* , **2025**, *100*, *103188*e202401938. DOI: 10.1016/j.jcou.2025.103188
   Together with another paper (*Energy Fuels* 2025, 39, 37, 17899), it demonstrates that proton accessibility to the electrocatalyst surface controls Faradaic selectivity toward C2+ products.
3. Water Structure in the First Layers on TiO_2: A Key Factor for Boosting Solar-Driven Water-Splitting Performances, S Perathoner et al. , *J Am Chem Soc* **2024**, *146*, 18061. DOI: 10.1021/jacs.4c05042
   This work reveals how doping the semiconductor surface affects the local electric field, thereby determining the water-splitting rate by influencing the H-bond topologies in the first water layers. This evidence opens new prospects for designing efficient photocatalysts for water splitting.
4. Making chemicals from the air: the new frontier for hybrid electrosyntheses in artificial tree-like devices. S Perathoner et al., *Green Chem.* **2024**, 26, 15. DOI: 10.1039/D3GC02135A
   It discussed how to make chemicals from the air using hybrid electrosynthesis technologies; this is a visionary objective that could revolutionise chemical production.
5. Mitigation of C-deposits in plasma-assisted non-oxidative methane coupling using a water-cooled double dielectric barrier discharge reactor, S Perathoner et al., *Chem. Eng. Journal*, **2025**, *517*, 164334. DOI: 10.1016/j.cej.2025.164334
   A radically different plasma chemistry is shown when reducing the discharge gap to the mm scale, resulting in plasma confinement near the electrode surface, which enhances selective C-H activation.
6. Boosting the activity in the liquid-phase hydrogenation of S-containing nitroarenes by dual-site Pt/CeO_2 catalysts design, S Perathoner et al., *Nature Comm.* **2025**, *16*, 4851. DOI: 10.1038/s41467-025-59920-x
   A new strategy for converting S-containing nitroarenes by developing a dual-sites Pt/CeO_2 catalyst consisting of highly defective CeO_2 with abundant active oxygen vacancy and Pt sub-nano clusters.
7. Develop High-Performance Cu-Based RWGS Catalysts by Controlling Oxide–Oxide Interface, S Perathoner et al., *ACS Catal.* **2025**, *15*, 3475-3486. DOI:10.1021/ acscatal.4c07729
   The paper introduces and demonstrates that high-performance, stable catalysts can be obtained by modifying the catalytic mechanism in Cu/CeO_x-MgO catalysts for CO_2 hydrogenation. H and CO_2 activation sites are decoupled but connected via the surface mobility of H-spillover species. The latter is realized via an enhanced oxide–oxide interface, allowing high performance and stability.
8. Generation of oxide surface patches promoting H-spillover in Ru/(TiO_x)MnO catalysts enables CO_2 reduction to CO, S Perathoner et al., *Nature Catal.* **2023**, *6*, 1062. DOI: 10.1038/s41929-023-01040-0
   The paper presents new perspectives for designing novel selective CO_2 hydrogenation catalysts by in situ forming oxide–oxide interfaces that serve as hydrogen-species transport channels.
9. An artificial leaf device built with earth-abundant materials for combined H_2 production and storage as formate with efficiency> 10%, S Perathoner et al., *Energy & Env Sci* **2023**, 16, 1644. DOI: 10.1039/D2EE03215E
   It reports a world-top-performing artificial-leaf-type cell with a solar-to-fuel efficiency of over 10% for directly converting CO_2, water, and sunlight into sustainable fuels and chemicals.
10. High photocatalytic yield in the non-oxidative coupling of methane using a Pd–TiO_2 nanomembrane gas flow-through reactor, S Perathoner et al. , *EES Catal.* **2024**, 2, 1164. DOI: 10.1039/D4EY00112E
    A novel flow-through photocatalytic reactor for the photocatalytic non-oxidative coupling of methane, giving high performance and selectivity to C2 hydrocarbons.

Siglinda PERATHONER - CV (additional indications)

Recent plenaries, keynotes and invited (selection)

2025-21

- Innovative scalable materials and devices for CO2 capture and valorisation into e-fuels, NEST - Network for Energy Sustainable Transition - Spoke 9 Conference, Sept. 12th 2024, Rome (Italy), invited
- Plasmonic catalysts at room temperature, DICP - Dalian (China), 17th Jan 2024, plenary
- The DANTE project: the INSTM-ENI cooperation for CO_2 conversion to e-fuels through an innovative approach, XIV INSTM Conference, 9-12 June 2024, Cagliari (Italy), invited
- Addressing complexity in bridging heterogeneous and photo/electrocatalysis. Why new concepts and approaches are required, Irsee X Symposium, 6-9 June 2024, KlosterIrsee, Germany, invited
- The role of (photo)electrocatalytic devices for a solar-based and circular-carbon economy, IC-MES2023 Algeria, 12-14 Nov 2023
- Electrocatalysis: facing the challenge of extending its use to go beyond fossil fuels, Europacat 2023, Prague, Czech Rep., 27/08-1/09 2023, keynote
- Chemical Industry and its evolution, School of Industrial Chemistry, Torino, 28 May- 1° June 2023, plenary
- Gas flaring and methane emissions, OMC (Med energy conference), 24 May 2023, Ravenna (Italy), roundtable moderator.
- Converting CO2 in an artificial leaf device built with earth-abundant materials for combined H_2 production and storage as formate with solar-to-fuel efficiency > 10%, 20th International Conference on Carbon Dioxide Utilization – ICCDU XX, Bari, June 25-29th, 2023, invited
- Bridging nanoscience and electrocatalysis to design advanced electrodes, 44th Int Conference on Coord. Chem., Au. 28th- Sept. 2th, 2022, Rimini, Italy. Invited
- OCEAN project: Electrodes synthesis and properties, $eCCU^3$ electrochemical utilisation workshop, March 30th 2022 - online, invited.
- Electrocatalysis: facing the challenge of extending its use to go beyond fossil fuels, Europacat 2021, Prague, Czech Rep., 29/08-3/09 2021, keynote (postponed 2023)
- EU GREEN WEEK 2021 PARTNER EVENT "Towards Zero Pollution in the Production of Green Fuels and Chemicals" June 4th 2021
- Italian Chemical Society (SCI), SCI2021, 23th Sept. 21, keynote.

2020-16

- SINCHEM Winter School 2020, Feb 4-6, 2020 Bologna, Italy; plenary lecture
- First International Bunsen-Discussion-Meeting on Fundamentals and Applications of (Photo) Electrolysis for Efficient Energy Storage, April 1 – 5, 2019 in Taormina, Italy; invited lecture
- Summer School "Making Business with new technologies within green chemistry & sustainable energy), plenary
- SGI-SIMP Conference (Geosciences for the environment, natural hazard and cultural heritage), Catania (Italy),12-14 Sept. 2018, invited
- CARBOCAT VIII - 8th International Symposium on Carbon for Catalysis, Porto (Portugal), 26th-29th June 2018, keynote
- 2018 BIST (Barcellona Institute of Science and Technology) Conference, June 27th, 2018, Barcellona (Spain), invited (The energy re-evolution: To be clean or not to be)
- Science Academy - Bologna Institute, 50th Years of Heterogeneous Catal., 22 June 2018, Bologna (Italy), invited
- Ernst Haage Symposium, November 22-24 2017, Mülheim - Germany, plenary
- Workshop on CO_2, Univ. Malaya (Kuala Lumpur, Malesia), 20 July 2017, plenary
- CIS-7 (7th Czech-Italian-Spanish Symposium on Catalysis), June 13-17th 2017, Trest (Czech Rep.), plenary
- Workshp on Science & Techn Innov for Brasil, UNESP Araraquara (Brasil), March, 9-10th, 2017, plenary
- Univ. of Malaya, Nanocat Lecturship, 19th Jan 2017, Kuala Lumpur (Malesia), plenary
- Workshop on "Next Generation Energy Storage Technologies: Challenges and Opportunities", 2-3rd December 2015, Taormina, Italy, New approaches to recycle CO2 and reduce emissions, invited
- NANOTECHITALY 2015 (Sect.: Bio-Inspired and Bio-Based Technologies), Bologna, Nov. 25 – 27th, 2015, Artificial photosynthetic leaves: their role for sustainable future, invited
- Third International Conference on Catalysis for renewable sources: fuel, energy, chemicals (CRS-3), Catania, , September 6-11, 2015, Integrating bio-and solar refineries: an effective new option, plenary

Awards and recognitions

2006: EU ELCAT project (coord. S. Perathoner): selected among EU success stories, one of the eight projects selected in the entire energy sector

2008: "Altran Foundation for Innovation", special award for the project on the development of artificial trees for the conversion of CO2

2010: finalist of the European Sustainable Chemistry Award 2010 (EuCheMS)

2011: "NanoInLife", a film produced by the European Commission to show the public the results of nanotechnologies; interview with S. Perathoner and presentation of the results on CO2 (one of the 10 examples selected in the EU from the entire nanotechnology sector)

2021: Mario Giacomo Levi Medal of the Italian Chemical Society, jointly with G. Iaquaniello (NextChem) for the innovative activity carried out in the field of Chemistry that led to industrial implementation.
2021: CAS (Chinese Academy of Sciences) President's International Fellowship Initiative, PIFI (Visiting Scientists)

Academia

2009-11: Member of the Board of the Italian Zeolite Association
2012: 14: Member of the Board of the interdivisional group of catalysis of the Italian Chemical Society
2022-25: Member of the Board of the Industrial Chemistry Division of the Italian Chemical Society

Visiting professor

2015-17: Academic Icon (Univ. Malaya, Kuala Lumpur, Malaysia)

International Activities

- UNIME Head of the European Doctorate SINCHEM (Sustainable Industrial Chemistry),
- UNIME manager of various international collaborations, including the Univ. Malaya (Kuala Lumpur, Malaysia) and the University of Queensland (Australia)
- collaboration (as evidenced by joint publications in the last 5 years) with over 10 research centres and companies around the world
- visiting professor Univ. Malaya (Malaysia) in the years 2015-2017
- tutor numerous PhD students with international tutors (5)
- a member of the international evaluation panel (Committee for the appointment of the director, Max Planck Institute for Chemical Energy Conversion, Germany)
- a member of the selection committee of international research projects (CE, ANR - France, EU)
- a member of the ICIQ candidate selection and evaluation committee (Tarragona, Spain)
- a member of the evaluation and selection committee Director ICIQ (Tarragona, Spain)

Supervision of Graduate Students and Postdoctoral Fellows

>60 Postdoc/PhD, Univ. Messina, Italy (now Dept. ChiBioFarAm). They are prof. (R. Arrigo, S. Chen, B.C. Marepally, A. Demet, S. Abate, P. Lanzafame, etc.) or in leading positions in companies, EU or public admin. (M. Freni, F. Vazzana, V. Mancuso, etc).

Chairperson Conferences

Selection of organised international conferences

- 8th European Workshop on Selective Oxidation (Turku, Finland, 9-30 Aug. 2007). Chairpersons: F.Cavani, V.C. Corberan, G Centi, G. Mestl, S. PERATHONER, P. Ruiz
- Catalysis for a Sustainable Chemistry: Walking to the Frontiers between Homogeneous and Heterogeneous Catalysis, Messina, May 4th, 2009. Chairperson: S. PERATHONER
- CIS-3/AIZ-2009 3rd Czech-Italian-Spanish Trilateral Meeting on catalysis and Micro/Meso-Porous Materials and IX National Conference on Science and Technology of Zeolites, 21-25th June, 2009, Acireale (CT). Chairpersons: S. PERATHONER, S. Quartieri
- 5th International Symposium on Carbon for Catalysis - Carbocat-V, June, 28th 30th, 2012 - Bressanone/Brixen. Chairpersons: C. Milone, L. Prati, S. PERATHONER
- 6th IDECAT/ERIC-JCAT Conference on Catalysis, Design advanced multifunctional catalysts for sustainable processes, 3-6th March 2013, Bressanone/Brixen. Chairpersons: S. PERATHONER, A. Jentys, C. Claver.
- XVII National Congress of Catalysis GIC 2013 and XI National Congress of Zeolites Science and Technology, 15 - 18 September 2013, Riccione, scientific committee
- XVIII Scuola Nazionale di Scienza e Tecnologia dei Materiali - Ischia 16-20 Luglio 2014, scientific committee
- 6th Czech-Italian-Spanish Conference on Molecular Sieves and Catalysis joint with GIC 2015 Congress (XVIII National Congress of Catalysis) and AIZ 2015 Congress (XII National Congress of Zeolites Science and Technology), 14th to 17th June, 2015, Amantea (CS), Italy. Chairpersons: G. Giordano, S. PERATHONER, L. Marchese.
- Europacat 2017, 13th European Congress on Catalysis, August 27 to 31, 2017 in Florence, Italy. Chairpersons: Gabriele CENTI, Rinaldo PSARO, Giorgio STRUKUL and Siglinda PERATHONER
- XIII Italian Congress of Zeolites Science and Technology (AIZ2017), 1-2 September 2017, Florence, Italy. Chairpersons: Siglinda Perathoner, Girolamo Giordano
- 4th Euro Asia Zeolite Congress (4th EAZC), 27th to 30th January 2019 in Taormina (ME), Italy . Chairpersons: Siglinda Perathoner, Girolamo Giordano, S.B. Hong
- Chair organisation XXII Congress of the Division of Industrial Chemistry of the Italian Chemical Society, Catania, 7-8th Nov. 2022
- Chair: 13th International Conference on Environmental Catalysis, Isola delle femmine (PA), Italy, June 2-5 2025

Reviewing for Journals (Selection)

Appl. Catal. B: Env., ACS Catal., Acc. Chem. Res., Chem. Rev., Chem. Soc. Rev., J. Energy Chem., J. CO2 Utiliz., Mater. Today, Green Chem., ChemSusChem, Chem. Eng. J., ACS Sustainable Chem. & Eng.

Reviewing of funding proposals (Selection)

ERC Starting, Advanced and Consolidator Grants; Horizon Europe and H2020; European Science Foundation, DFG (Germany), JSPS (Japan), QNRF/UREP (Qatar), PRIN (Italy), FAPESP (Portugal)

Editorships (Selection)

2025 Editor of the book "Unlocking the Future of Renewable Energy and Chemistry through Catalysis ", Elsevier, Studies in Surface Science and Catalysis series, Vol. 180, ISBN: 978-0443333316

2019 Editor of the book "Horizons in Sustainable Industrial Chemistry and Catalysis", Elsevier, Studies in Surface Science and Catalysis series, Vol. 178, ISBN: 9780444641274

2017 Editor of the special issue "New Concepts and Advances in Photocatalytic Materials for Sustainable Energy", J. Energy Chemistry 2017, 26(2), 26(2).

2014 Editor of the book "Green Carbon Dioxide: Advances in CO2 Utilisation", Wiley & Sons, ISBN: 978-1-118-59088-1

2009 Editor of the book "Sustainable Industrial Chemistry: Principles, Tools and Industrial Examples", Wiley VCH, ISBN: 978-3-527-31552-9

Major collaborations

- Prof. Robert Schlögl, FHI-MPG - Berlin and MPI/CEC-Mühlheim, Germany, on carbon nanomaterials and (electro)catalysis (11 publications).
- Prof. Regina Palkovits, RWTH Aachen, Germany, on CO2 conversion catalysts (4 publications, sharing PhD students as part of the Europ. Doctorate SINCHEM).
- Prof. D.S. Su and Prof. Y. Liu, DICP-CAS, Dalian, China, on nanocarbon materials (15 publications).
- Prof. E.A. Quadrelli, CPE-Lyon, France, on CO2 conversion (9 publications, sharing PhD students as part of the Europ. Doctorate SINCHEM)
- Prof. G. Iaquaniello, NextChem Company, Rome, Italy development and process assessment (10 publications, joint Levi Medal award for the innovative activity leading to industrial implementation).
- Dr. E. De Jong and others, Avantium Co., Amsterdam, The Netherlands (Marie Curie Industry-Academia Partnerships and Pathways, the collaboration in various EU projects: OCEAN, PERFORM, etc.)

Institutional Responsibilities (Selection)

2022-today Member of the Board of the Industrial Chemistry Division of the Italian Chemical Society

2021- today Coordinator of the Sustainability and Environmental Innovation (SIA) degree course, class L-27, Univ. Messina - Italy, Dept. ChiBioFarAm

2021- today Member of the National Commission for Scientific Evaluation 03 / C2

2019- today Board of Directors of the INSTM Materials Science and Techn. Consortium, Firenze, Italy

Projects (Selection)

2011-2021 Coordinator of EU projects: INCAS (ID45988, 2010-14), OCEAN (ID767798, 2017-21)
PI in EU projects: TERRA (ID67747, 2015-19), ECO2CO2 (ID 309701, 2012-16), BIOFUR (ID324292, 2013-16), PERFORM (ID 820723, 2019-23), RECODE (ID 768583, 2017-22), A-LEAF (ID732840, 2017-21). The projects OCEAN, RECODE, ECO2CO2, PERFORM led to the realisation of TRL 5-6 electrocatalytic pilot units.

2011-2021 Coordinator PRIN2017 (2017WR2LRS), Italy National Projects; PI for UniME in PRIN2015 (2015L5XBSM), PRIN2010-11 (2010A2FSS9), Italy National Projects

Qualification

- Top Italian Scientists: among the top 5 female researchers in chemistry working in Italy (as h-index)
- SciVal (Elsevier – Scopus, 2011-2020): 245% and 140% increase to the world average for chemistry in Field-Weighted Views and Citation, respectively
- SciVal (Elsevier - Scopus, 2011-2020): 153 publ., 73,2% in Q1 (CiteScope), 47.1% in top 10% and 10% in top 1% journals, 19,356 Scopus views (64.1% in top 10% most viewed)
- Qualification of peer-reviewed articles (IRIS): WoS Average IF5Y= 6,327 Max. IF5Y=48,832, WoS Average Citations= 47,169 Max. Citations= 905
- SciVal (Elsevier - Scopus, 2011-2020): 43.2 average nr citations per public., 21 patents citing, 123.5 average Patent-Citations per 1,000 Scholarly Outputs, 37.1% Intern. collaboration, Top collaborating Institutions: Chinese Academy of Sciences (13 public.), CNRS (12 publ.), Max Planck Society (11 publ.), Inst. of Metal Research – China (10 publ.).
- 11 plenaries, 5 keynotes, > 20 invited in the last 10 years
- Chairperson in international conferences: 6 in years 2011-2021
- Editor of books and special issues of international journals: 6 in years 2011-2021
- Monographs and Encyclopedia: 3 in years 2011-2021 + 1 international roadmap on catalysis
- Recognised industrial innovation leadership: award from S.C.I., Levi Medal

Monographs and Encyclopaedia (last 10 years)

2024 Centi, G., Perathoner, S. Catalytic Technologies for the Conversion and Reuse of CO_2. In: Lackner, M., Sajjadi, B., Chen, WY. (eds) Handbook of Climate Change Mitigation and Adaptation. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-6431-0_119-

2024 Centi, G., Perathoner, S. Reduction of Non-CO_2 Greenhouse Gas Emissions by Catalytic Processes. In: Lackner, M., Sajjadi, B., Chen, WY. (eds) Handbook of Climate Change Mitigation and

Adaptation. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-6431-0_49-4

2021 G. Centi, S. Perathoner, Handbook of Climate Change Mitigation and Adaptation. Springer. (Entry 1: Catalytic Technologies for the Conversion and Reuse of CO2, 50 pages; DOI: 10.1007/978-1-4614-6431-0_119-1; Entry 2: Reduction of non-CO2 Greenhouse Gas Emissions by Catalytic Processes, 44 pages, DOI: 10.1007/978-1-4614-6431-0_49-3)

2016 S. Perathoner, G. Centi, Science and Technology Roadmap on Catalysis for Europe, European Cluster on Catalysis, ERIC Pub., Brussels 2016, ISBN 979-12-200-1453-3

2014 G. Centi, S. Perathoner, Artificial Leaves, Kirk-Othmer Encyclopedia of Chemical Technology, Wiley, April 2014, DOI: 10.1002/0471238961.articent.a01

2013 G. Centi, S. Perathoner, Mixed-metal oxides, Comprehensive Inorganic Chemistry II (Vol. 7), 31 pages, Elsevier 2013, DOI:10.1016/B978-0-08-097774-4.00718-X

CASPE centre

Director from 2016 of the CASPE centre (Catalysis and sustainable processes), (catalysis.unime.it), particularly active in the European field with over 20 European projects and also a reference centre for the INSTM University Consortium on science and technology of materials (www.instm.it) and the European Research Institute of Catalysis (ERIC aisbl, Brussels; www.eric-aisbl.eu). The center comprises 10 professors and researchers, with an average of about 30 PhD and postdocs.

The scientific skills available at CASPE are strong and internationally recognized in catalytic processes for energy and green hydrogen. CASPE has numerous testing lines for catalysts in flow reactors (including high-throughput) and autoclaves, testing lines for electro- and photocatalysts, and testing lines for the combination of non-thermal plasma and catalysis. The center has extensive i) analytical instrumentation (various GCxMS, GCxGXxMS, HPLC-MS, IC, AA, etc.), ii) equipment for the characterization of solids (BET, porosity, chemisorption, TPR / TPO, TG-MS, Raman, FTIR, UV-vis reflectance, XRD-EDX) and iii) surfaces (XPS, AFM, FTIR with cells to study chemisorption), iv) devices for the preparation of catalysts and electrodes, also on a prototype scale.

National projects

NATIONAL COORDINATOR

- PRIN 2017: CO_2 as only source of carbons for monomers and polymers: a step forwards circular economy (CO_2 ONLY), national scientific coordinator

RESPONSABLE SCIENTIFIC PRINCIPAL INVESTIGATOR (PI)

- PRIN 2003: Materiali multifunzionali nanostrutturati con migliorata attività fotocatalitica. 24th months, Scientific responsible for UniME
- PRIN 2007: Sustainable 2nd generation H2 production processes from renewable sources, 24th months, Scientific responsible for UniME
- PRIN 2010: CO2 activation mechanisms for the design of new materials for energy and resource efficiency, 36th months, Scientific responsible for UniME
- PON01_01725: New Photovoltaic Technologies for Intelligent Systems Integrated in Buildings (Photovoltaic), 36th months from 1st Oct 2011, Scientific responsible for UdR UniME
- PON02_00355_3416798. ENERGETIC: Technologies for ENERGY and Energy Efficiency , 36th months from 1st Jan 2012, Scientific responsible for UdR UniME
- INSTM/ Lombardia Region 2013: Lanthanum ferrites for new energy sources (Ferriti-NFE), 24th months, Scientific responsible for UdR ME of INSTM

PROJECT COORDINATOR

- FISA-2022-00277, Project "SCOOP-Novel Solar cells for solar-to-hydrogen COntinuOus Production", Project Responsible and PI, MUR (Italy)
- FP6-2003-NEST-A: Electrocatalytic Gas-Phase Conversion of CO2 in Confined Catalysts (ELCAT), 42th months, Coordinator of the project

EU Projects (as PI)

- FP5-ICA3-2002-10096 Novel Catalytic Technologies for the treatment of wastewater from Agro-food and industrial productions in MED Countries, 36th months, Coordinator of the project
- FP7-NMP2-LA-2010-245988 Integration of Nanoreactor and multisite CAtalysis for Sustainable chemical production (INCAS), 48th months, Coordinator of the project
- H2020-767798: Oxalic acid from CO2 using Electrochemistry At demonstratioN scale (OCEAN), on-going, 48th months, Coordinator of the project
- FP6-2002-NMP-1: Coordination of Nanostructured Catalytic Oxides Research and Development in Europe (CONCORDE), 27th months, scientific responsible for UdR UniME
- FP6-2004-NMP-32583 Nano-engineered thin films for advanced materials applications (NATAMA), 36th months, Scientific responsible for UdR ME
- FP7-2012- 309701: Eco-friendly biorefinery fine chemicals from CO_2 photo-catalytic reduction (ECO2CO2), 36th months, Scientific responsible for UdR ME
- FP7-2014- 621210 (FCH JU). Integrated High-Temperature Electrolysis and Methanation for

Effective Power to Gas Conversion (HELMETH), 36th months, Scientific responsible UdR ME532475-1-IT-2012-1-ERA MUNDUS-EMJD Erasmus Mundus Joint Doctorate Programmes "Sustainable INdustrial CHEMistry", 96th months, Scientific responsible for UdR ME

- IAPP CONTRACT 324292-2013. BIOFUR: BIOpolymers and BIOfuels from FURan based building blocks. A Marie Curie Industry-Academia Partnerships and Pathways, 36th months, Scientific responsible for UdR ME
- FETPROACT-2016, An Artificial Leaf: a photo-electro-catalytic cell from earth-abundant materials for sustainable solar production of CO2-based chemicals and fuels (A-LEAF) "Project ID: 732840, scientific responsible for UdR ME
- H2020-NMBP-ST-IND-2018-2020, PowerPlatform: Establishment of platform infrastructure for highly selective electrochemical conversions (PERFORM), project 820723, Scientific responsible UdR ME

Industrial projects

- Project with ALTA, 1 year (2010)
- Project with Toyota, 2 year (2011-2012)
- DANTE project (coordinator) financed by Eni, 3 years, 2024-2027

Research Profile

Starting from the initial background on the photophysics of supramolecular complexes, the scientific focus of Prof. Perathoner then moved to the industrial development of catalytic materials and processes initially for environmental applications (water emissions, NOx abatement in stationary and mobile emissions) and then for sustainable energy and chemical production, particularly electro- and photocatalytic applications, H_2 production from waste, energy materials based on nanocarbon.

Her research interests include nanostructured oxides, micro-/mesoporous materials, and nanocarbons for catalytic applications, and the use of solar energy to convert small molecules (CO_2, H_2O, and N_2). While focusing on fundamental aspects and reaction mechanisms, the core of the activities was to transfer basic research into practical applications. The most significant part of the research was conducted within the framework of European projects involving many companies, in some cases also coordinating the projects.

Four prototype or pilot industrial units for electrocatalytic processes were realized. Various waste-to-H2 plants are under construction. Among the pioneering activities, the development of

1. electrocatalysts for the direct electroreduction of CO_2 to C2-C3 hydrocarbons/alcohols (among the first reporting this possibility already over 15 years ago),
2. artificial-leaf type device for CO_2 reduction (with now world-record solar-to-fuel efficiencies of over 10% at high current density),
3. electrolyte-less electrocatalytic devices (now becoming of broad use to overcome limitations of the current devices),
4. electrodes based on ordered arrays of TiO_2 nanotubes for photo- and electrocatalytic reactions,
5. metal-free nanocarbons for catalytic and electrocatalytic applications,
6. catalytic solutions for carbon circularity (CO_2 reuse),
7. a process to produce H_2 from municipal waste (implemented on an industrial scale)
8. the use of iron-oxide on nanocarbons electrocatalysis for the N_2 electrocatalytic conversion to ammonia.

In parallel with scientific developments, intense activity was also undertaken in perspective papers, leading to highly cited, pioneering manuscripts on nanocarbons, layered materials, CO_2 recycling and utilization, solar fuels and artificial leaf, and fossil-free chemical production. In addition, the editor of three books on Sustainable Industrial Chemistry and Green Carbon Dioxide, and contributions to encyclopedias

References

(1) (a) Kang, H.; Ma, L.; Li, S.; Chen, X.; Chu, W.; Zhang, R.; Perathoner, S.; Centi, G.; Liu, Y. Oxygen vacancy-dependent chemical intermediates on Ru/MnO catalysts dictate the selectivity of CO_2 reduction. *Applied Catalysis B: Environment and Energy* **2024**, *352*, 124010, DOI: https://doi.org/10.1016/j.apcatb.2024.124010. (b) Kang, H.; Zhu, L.; Li, S.; Yu, S.; Niu, Y.; Zhang, B.; Chu, W.; Liu, X.; Perathoner, S.; Centi, G.; et al. Generation of oxide surface patches promoting H-spillover in Ru/(TiOx)MnO catalysts enables CO_2 reduction to CO. *Nature Catalysis* **2023**, *6* (11), 1062–1072, DOI: 10.1038/s41929-023-01040-0. (c) Longo, V.; De Pasquale, L.; Perathoner, S.; Centi, G.; Genovese, C. Synergistic effects of light and plasma catalysis on Au-modified TiO_2 nanotube arrays for enhanced non-oxidative coupling of methane. *Catal. Sci. & Tech.* **2025**, *15* (12), 3725–3735, DOI: 10.1039/D5CY00206K. (d)

Longo, V.; De Pasquale, L.; Tavella, F.; Barawi, M.; Gomez-Mendoza, M.; de la Peña O'Shea, V.; Ampelli, C.; Perathoner, S.; Centi, G.; Genovese, C. High photocatalytic yield in the non-oxidative coupling of methane using a Pd–TiO_2 nanomembrane gas flow-through reactor. *EES Catal.* **2024**, *2* (5), 1164–1175, DOI: 10.1039/D4EY00112E. (e) Longo, V.; Perathoner, S.; Centi, G.; Genovese, C. Mitigation of C-deposits in plasma-assisted non-oxidative methane coupling using a water-cooled double dielectric barrier discharge reactor. *Chem. Eng. J.* **2025**, *517*, 164334, DOI: https://doi.org/10.1016/j.cej.2025.164334. (f) Ren, X.; Huang, J.; Ma, J.; Zhang, Y.; Chu, W.; Perathoner, S.; Centi, G.; Liu, Y. Boosting the activity in the liquid-phase hydrogenation of S-containing nitroarenes by dual-site Pt/CeO_2 catalysts design. *Nat. Comm.* **2025**, *16* (1), 4851, DOI: 10.1038/s41467-025-59920-x. (g) Verduci, R.; Creazzo, F.; Tavella, F.; Abate, S.; Ampelli, C.; Luber, S.; Perathoner, S.; Cassone, G.; Centi, G.; D'Angelo, G. Water Structure in the First Layers on TiO2: A Key Factor for Boosting Solar-Driven Water-Splitting Performances. *J. Am. Chem. Soc.* **2024**, *146* (26), 18061–18073, DOI: 10.1021/jacs.4c05042. (h) Gianolio, D.; Higham, M. D.; Quesne, M. G.; Aramini, M.; Xu, R.; Large, A. I.; Held, G.; Velasco-Vélez, J.-J.; Haevecker, M.; Knop-Gericke, A.; et al. Interfacial Chemistry in the Electrocatalytic Hydrogenation of CO_2 over C-Supported Cu-Based Systems. *ACS Catal.* **2023**, *13* (9), 5876–5895, DOI: 10.1021/acscatal.3c01288.

(2) (a) Ampelli, C.; Giusi, D.; Miceli, M.; Merdzhanova, T.; Smirnov, V.; Chime, U.; Astakhov, O.; Martín, A. J.; Veenstra, F. L. P.; Pineda, F. A. G.; et al. An artificial leaf device built with earth-abundant materials for combined H_2 production and storage as formate with efficiency > 10%. *Energy & Env. Sci.* **2023**, *16* (4), 1644–1661, DOI: 10.1039/D2EE03215E. (b) Ampelli, C.; Tavella, F.; Giusi, D.; Ronsisvalle, A. M.; Perathoner, S.; Centi, G. Electrode and cell design for CO2 reduction: A viewpoint. *Catal. Today* **2023**, *421*, 114217, DOI: https://doi.org/10.1016/j.cattod.2023.114217. (c) Abramo, F. P.; De Luca, F.; Passalacqua, R.; Centi, G.; Giorgianni, G.; Perathoner, S.; Abate, S. Electrocatalytic production of glycolic acid via oxalic acid reduction on titania debris supported on a TiO_2 nanotube array. *J. Energy Chem.* **2022**, *68*, 669–678, DOI: https://doi.org/10.1016/j.jechem.2021.12.034. (d) Giusi, D.; Ampelli, C.; Genovese, C.; Perathoner, S.; Centi, G. A novel gas flow-through photocatalytic reactor based on copper-functionalized nanomembranes for the photoreduction of CO_2 to C1-C2 carboxylic acids and C1-C3 alcohols. *Chem. Eng. J.* **2021**, *408*, 127250, DOI: https://doi.org/10.1016/j.cej.2020.127250. (e) Giusi, D.; Miceli, M.; Genovese, C.; Centi, G.; Perathoner, S.; Ampelli, C. In situ electrochemical characterization of CuxO-based gas-diffusion electrodes (GDEs) for CO_2 electrocatalytic reduction in presence and absence of liquid electrolyte and relationship with C2+ products formation. *Applied Catalysis B: Environmental* **2022**, *318*, 121845, DOI: https://doi.org/10.1016/j.apcatb.2022.121845.

(3) (a) Centi, G.; Perathoner, S. Making chemicals from the air: the new frontier for hybrid electrosyntheses in artificial tree-like devices. *Green Chem.* **2024**, *26* (1), 15–41, DOI: 10.1039/D3GC02135A. (b) Centi, G.; Perathoner, S.; Genovese, C.; Arrigo, R. Advanced (photo)electrocatalytic approaches to substitute the use of fossil fuels in chemical production. *Chem. Comm.* **2023**, *59* (21), 3005–3023, DOI: 10.1039/D2CC05132J. (c) Papanikolaou, G.; Centi, G.; Perathoner, S.; Lanzafame, P. Catalysis for e-Chemistry: Need and Gaps for a Future De-Fossilized Chemical Production, with Focus on the Role of Complex (Direct) Syntheses by Electrocatalysis. *ACS Catal.* **2022**, *12* (5), 2861–2876, DOI: 10.1021/acscatal.2c00099. (d) Romano, V.; D'Angelo, G.; Perathoner, S.; Centi, G. Current density in solar fuel technologies. *Energy & Env. Sci.* **2021**, *14* (11), 5760–5787, DOI: 10.1039/D1EE02512K.

(4) (a) Centi, G.; Perathoner, S. Catalysis for an electrified chemical production. *Catal. Today* **2023**, *423*, 113935, DOI: https://doi.org/10.1016/j.cattod.2022.10.017. (b) Centi, G.; Perathoner, S. Electrocatalysis: Prospects and Role to Enable an E-Chemistry Future. *The Chem. Rec.* **2025**, *25* (6), e202400259, DOI: https://doi.org/10.1002/tcr.202400259. (c) Papanikolaou, G.; Centi, G.; Perathoner, S.; Lanzafame, P. Transforming catalysis to produce e-fuels: Prospects and gaps. *Chi. J. Catal.* **2022**, *43* (5), 1194–1203, DOI: https://doi.org/10.1016/S1872-2067(21)64016-0. (d) Centi, G.; Perathoner, S. Addressing the Complexity of Bridging Thermal and Reactive Catalysis. The Role of Strong Localised Electrical Fields. *Top. Catal.* **2025**, DOI: 10.1007/s11244-025-02062-7.

(5) (a) Ampelli, C.; Centi, G.; Passalacqua, R.; Perathoner, S. Synthesis of solar fuels by a novel photoelectrocatalytic approach. *Energy & Env. Sci.* **2010**, *3* (3), 292–301, DOI: 10.1039/B925470F. (b) Centi, G.; Perathoner, S.; Winè, G.; Gangeri, M. Electrocatalytic conversion of CO2 to long carbon-chain hydrocarbons. *Green Chem.* **2007**, *9* (6), 671–678, DOI: 10.1039/B615275A.

(6) Ampelli, C.; Genovese, C.; Marepally, B. C.; Papanikolaou, G.; Perathoner, S.; Centi, G. Electrocatalytic conversion of CO_2 to produce solar fuels in electrolyte or electrolyte-less configurations of PEC cells. *Faraday Discussions* **2015**, *183* (0), 125–145, DOI: 10.1039/C5FD00069F.

(7) (a) Centi, G.; Perathoner, S. Opportunities and prospects in the chemical recycling of carbon dioxide to fuels. *Catal. Today* **2009**, *148* (3), 191–205, DOI: https://doi.org/10.1016/j.cattod.2009.07.075. (b) Quadrelli, E. A.; Centi, G.; Duplan, J.-L.; Perathoner, S. Carbon Dioxide Recycling: Emerging Large-Scale Technologies with Industrial Potential. *ChemSusChem* **2011**, *4* (9), 1194–1215, DOI: https://doi.org/10.1002/cssc.201100473. (c) Centi, G.; Quadrelli, E. A.; Perathoner, S. Catalysis for CO2 conversion: a key technology for rapid introduction of renewable energy in the value chain of chemical industries. *Energy & Env. Sci.* **2013**, *6* (6), 1711–1731, DOI: 10.1039/C3EE00056G.

(8) Su, D. S.; Perathoner, S.; Centi, G. Nanocarbons for the Development of Advanced Catalysts. *Chem. Rev.* **2013**, *113* (8), 5782–5816, DOI: 10.1021/cr300367d.

(9) Centi, G.; Perathoner, S.; Salladini, A.; Iaquaniello, G. Economics of CO_2 Utilization: A Critical Analysis. *Frontiers in Energy Research* **2020**, *Volume 8 - 2020*, DOI: 10.3389/fenrg.2020.567986.

(10) Centi, G.; Iaquaniello, G.; Perathoner, S. Can We Afford to Waste Carbon Dioxide? Carbon Dioxide as a Valuable Source of Carbon for the Production of Light Olefins. *ChemSusChem* **2011**, *4* (9), 1265–1273, DOI: https://doi.org/10.1002/cssc.201100313.

(11) Genovese, C.; Ampelli, C.; Perathoner, S.; Centi, G. Mechanism of C–C bond formation in the electrocatalytic reduction of CO2 to acetic acid. A challenging reaction to use renewable energy with chemistry. *Green Chem.* **2017**, *19* (10), 2406–2415, DOI:

10.1039/C6GC03422E.

(12) Genovese, C.; Schuster, M. E.; Gibson, E. K.; Gianolio, D.; Posligua, V.; Grau-Crespo, R.; Cibin, G.; Wells, P. P.; Garai, D.; Solokha, V.; et al. Operando spectroscopy study of the carbon dioxide electro-reduction by iron species on nitrogen-doped carbon. *Nat. Comm.* **2018**, *9* (1), 935, DOI: 10.1038/s41467-018-03138-7.

(13) Centi, G.; Perathoner, S.; Papanikolaou, G. Plasma assisted CO2 splitting to carbon and oxygen: A concept review analysis. *Journal of CO2 Utilization* **2021**, *54*, 101775, DOI: https://doi.org/10.1016/j.jcou.2021.101775.

(14) (a) Chen, S.; Perathoner, S.; Ampelli, C.; Mebrahtu, C.; Su, D.; Centi, G. Electrocatalytic Synthesis of Ammonia at Room Temperature and Atmospheric Pressure from Water and Nitrogen on a Carbon-Nanotube-Based Electrocatalyst. *Ang. Chem. Int. Ed.* **2017**, *56* (10), 2699–2703, DOI: https://doi.org/10.1002/anie.201609533. (b) Wei, H.; Jiang, Q.; Ampelli, C.; Chen, S.; Perathoner, S.; Liu, Y.; Centi, G. Enhancing N2 Fixation Activity by Converting Ti3C2 MXenes Nanosheets to Nanoribbons. *ChemSusChem* **2020**, *13* (21), 5614–5619, DOI: https://doi.org/10.1002/cssc.202001719. (c) Chen, S.; Perathoner, S.; Ampelli, C.; Wei, H.; Abate, S.; Zhang, B.; Centi, G. Enhanced performance in the direct electrocatalytic synthesis of ammonia from N_2 and H_2O by an in-situ electrochemical activation of CNT-supported iron oxide nanoparticles. *J. Energy Chem.* **2020**, *49*, 22–32, DOI: https://doi.org/10.1016/j.jechem.2020.01.011.